Structure and Sedimentology of the Dundas Group, western Tasmania.

by

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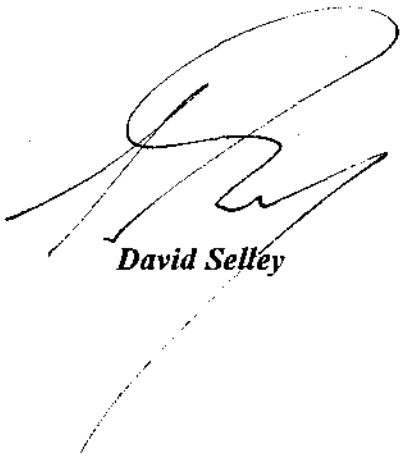

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ABSTRACT

Middle and Late Cambrian sediments and minor intrusives of the Dundas Group form the western most exposures in the Mt Read volcanic belt of western Tasmania. The Dundas Group comprise at least 2500 m of clastic sediments with rare pumice-bearing quartz and feldspar-phyric volcaniclastics, minor quartz-feldspar porphyritic intrusives and andesitic to dacitic lavas. Volcanogenic deposits become less abundant towards the western limits of the unit, where lithologies are characterised by thick polymict conglomerate packages which occur intercalated with mudstone and thinly bedded sandstone. Structural and stratigraphic complexities of the Dundas area, with particular emphasis on the Dundas Group, provide the focus of this study.

The provenance of the Dundas Group is linked to the presently exposed basement lithologies and coeval volcanics. These include the tholeiite dominated Crimson Creek Formation, boninites, gabbros and peridotites of the Serpentine Hill Complex, older mature meta-sandstones, and the volcanics of the Mount Read volcanic 'arc'. All these sources were detected in the conglomerates and sandstones of the Dundas Group. Suite 1 samples are dominated by Crimson Creek Formation with some contamination from mature sedimentary rocks and the mafic/ultramafic complexes. Suite 1B samples have been identified as Crimson Creek Formation rather than Dundas Group on the basis of their provenance. Suite 2 samples have been derived from the mafic/ultramafic complex and a felsic source. Suite 3 has a broad range of compositions consistent with thorough mixing of detritus derived from two or more sources. Suite 4 samples are mature sandstones which have a metasedimentary source. The distinction of Dundas Group suite 4 samples from the basement sandstones is very difficult with presence of distinctive traces of chromite very useful in recognising the younger Dundas Group sandstones. Suites 1B and 4 sandstones from the eastern zone have been tentatively identified as basement lithologies faulted up within the footwall of the Rosebery Fault.

Deposition of suite 3 siliciclastics occurred during the middle Middle Cambrian in the western area, but continued into the earliest Late Cambrian in the central area. During the latter period, suite 1A sediments were being deposited along the western margin of the basin, whereas coeval finer-grained suite 3 sediments occupied central or eastern portions of the basin. This asymmetry in lithofacies distribution from west to east reflects proximal derivation of suite 1A conglomerates and sandstones from rapidly uplifted basement sources to the west, with supply of thoroughly mixed sediment to the east.

The western-most exposures of the Dundas Group involve petrographically and chemically similar conglomerate-greywacke-mudstone successions which crop out at Dundas and at Que River to the north. These range in age from latest Middle Cambrian to probable Late Cambrian and represent a marked change in basin geometry characterised by rapid basement uplift. This phase of tectonism and associated sedimentation is coeval with the onset of thrusting and molasse-type Owen Conglomerate deposition further to the

east. In the western parts of the Mt Read volcanic belt, however, basin subsidence and quiescent marine sedimentation persisted until the middle late Cambrian. This asymmetry in facies architecture and basin evolution across the Mt Read volcanic belt corresponds to diachronous Late Cambrian E-W and downwarping of thin continental crust to the west of an advancing fold and thrust belt.

The earliest deformation recognised in the Dundas Group (D_1) is characterised by pre-lithification deformation features which include coherent slides along bedding parallel surfaces, chaotic zones of liquefaction, brittle fault zones and slump folds. These structures relate to syn-sedimentary seismic shock and/or gravitational collapse following basin-floor tilting.

Regional cleavage development and upright, open to tight folding correspond to the earliest phase of Middle Devonian orogenesis (D_2) . The S_2 cleavage is the dominant penetrative fabric developed throughout the Dundas region. Mesoscopic and macroscopic folds related to S_2 are upright to moderately inclined and shallowly to moderately plunging, however the trend of hinge lines is quite variable, ranging from NNW-SSE to NE-SW. The S_2 cleavage is almost always non-axial planar. The cleavage transection is interpreted to be the result of imposition of an ENE-WSW directed D_2 shortening axis on an earlier, pre-D_2 generation of NNE- to NE-trending mesoscopic and macroscopic folds. The pre-D_2 folds generation is tentatively correlated with a regionally developed phase of Late Cambrian E-W to NE-SW compression.

Structural relationships in the Dundas region are most complicated towards the east and culminate in tightly folded and disrupted strata positioned within the footwall of the Rosebery Fault. These rocks are characterised by the dissection of a N-S trending upright folds by an anastomosing array of steeply dipping shear zones. Where shear zones were developed in originally well stratified lithotypes with marked competency contrast, melange-type textures have formed. Domains of melange-type deformation are well exposed in the Ring River. The dominant texture common to all disrupted units is partially to completely fragmented sedimentary layers enclosed within a fine-grained and frequently fissile argillaceous matrix. Partitioning of strain and variation of deformation styles throughout the disrupted domains occurs primarily as a function of the original sedimentary lithotypes. Three broad mesoscopic styles are defined: i) "high strain" phacoid zones , ii) domains of large-scale boudinage and pinch-and-swell structure and iii) chaotic block-in-matrix structure. Bulk flattening-type strains in the Ring River melange is indicated by chocolate tablet boudinage structure and development of orthogonal extensional vein generations. The favoured interpretation for the development of the Ring River melange is the tightening and rotation of upright, shallowly plunging, NNE- to NE-trending pre-D_2 folds during oblique imposition of NNW to N striking D_2 slaty and spaced cleavages.

The melange textures formed under conditions of intense flattening strains, low effective confining pressure , marked competency contrast and relaxation of along strike boundary constraints to allow stretching in two directions. These conditions are common in accretionary environments but are not restricted to them. Similar conditions can occur in other upper crustal locations and produce melange from well-consolidated ancient rocks. The spatial relationships in the Ring River and throughout the eastern part of the Dundas region provide no support for the model that this melange was developed in an accretionary environment as suggested by Corbett and Lees (1987).

Four principal contentious issues are addressed here. Firstly the nature of the lower contact of the Dundas Group in the Ring River. This locality has been singled out as a critical test for one of the favoured tectonic models for western Tasmania. The work provided here indicates that this is a normal nonconformable contact as required by this model. The second major issue is the distribution of basement lithologies faulted into the eastern part of the map area. Major advances in the recognition of these blocks was produced by the detailed provenance studies. Thirdly, historical difficulty in constructing a coherent vertical and lateral stratigraphy in the Dundas region has been attributed to deposition within a series of sub-basins, which were periodically isolated from one another and derived material from different sediment dispersal systems. Finally the nature and significance of the melanges and disrupted zones along the Rosebery tectonic zone was given very detailed attention and the model that they are sufficient evidence to suggest a suture zone has been disproved.

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